CLAIMS

1. A process used to scan a complex surface (100) delimited at least in part by a physical barrier (102, 302) and/or obstacles (414), where the said process includes the following stages:

a) a stage to detect the said physical barrier (102, 302) and/or the said obstacles (414),

b) an initial stage whose purpose is either:

• to traverse, in a first direction (114, 314), at least in part, an initialisation strip (118_i, 318_i)running along the said physical barrier (102, 302) and scanning the said strip (118_i, 318_i), until the said physical barrier (102, 302) presents an angular rupture (120, 320) whose value is outside the limits of a predetermined range of permitted values, and then

• to traverse (200) in the other direction (116, 316), in its entirety, the said initialisation strip (118_i, 318_i) running along at least one part of the said physical barrier until the said physical barrier presents an angular rupture (122, 322) whose value is outside the limits of a predetermined range of permitted values ;

or, wherever possible, to traverse, in a single run, a initialisation strip running along at least one part of the said physical barrier contained between two angular ruptures of the said physical barrier whose values fall outside the limits of a predetermined range of permitted values,

where said process also includes, during the said initial stage, a stage (202) to calculate the length (L_0) of the initialisation strip from the geometrical data (angles and lengths) characterising the geometry of the initialisation strip ;

where the said process executes an iterative process initialised by the journey over the said initialisation strip and continuing by the journey over strips hereafter successively called the previous strip (118_p, 120_p, 322_p), the current strip (118_c, 120_c, 320_c, 322_c) and the next strip (118_s, 120_s, 320_s, 322_s), where the first previous strip (118_p, 318_p) is composed of the said initialisation strip (118_i, 318_i),

where the said initialisation strip (118_i, 318_i), the said current strips (118_c, 120_c, 320_c, 322_c), the said previous strips (118_p, 120_p, 322_p) and the said next strips (118_s, 120_s, 320_s, 322_s) have a predetermined width (d),

with the said process being such that the parts of the complex surface scanned during the stages preceding the current stage are assumed to be located within the physical barrier delimiting the complex surface ;

c) where the said process also includes the following successive stages:

c1) a stage (204) to predetermine the length (L^*_i) of the said current strip from the geometrical data characterising the geometry of the said previous strip,

c2) a stage (206) to traverse, the said current strip in its entirety running along the said previous strip until the said current strip presents an angular rupture whose value is outside the limits of a predetermined range of permitted values,

c3) a stage (208) to determine the length (L_i) of the said current strip from the geometrical data obtained during the journey over the said current strip and characterising the geometry of the said current strip,

c4) a stage (210) to compare the predetermined length (L^*_i) with the determined length (L_i), so that:

• if the predetermined length (L^*_i) is more or less equal to the determined length (L_i), then stage c5) of the process is implemented,

• if the predetermined length (L^*_i) is greater than the determined length (L_i), it is assumed that an obstacle is present on the current strip, and stage c6) of the process is implemented,

• if the predetermined length (L^*_i) is less than the determined length (L_i), it is assumed that the physical barrier comprises a discontinuity in the said current strip, and stage c7) of the process is implemented,

c5) a stage (212) to pass to the next strip by laterally offsetting the trajectory over a distance that is more or less equal to the predetermined width (d) of one of the said current strips,

a stage to traverse the next strip in the direction opposite to that of the current strip,

a stage to iterate the process from stage c1), as many times as necessary in order to scan the complex surface, where the former current strip is considered to be the new previous strip while the next strip is now considered to be the new current strip,

c6)

• if the obstacle extends over the width (d) of the current strip, then stage (241a) is used to pass to the next strip by laterally offsetting the trajectory over a distance that is more or less equal to the predetermined width (d) of one of the said current strips,

a stage to traverse the next strip in the direction opposite to that of the current strip,

a stage to iterate the process from stage c1), as many times as necessary in order to scan the complex surface, the former current strip now being considered to be the new

previous strip while the next strip is now considered to be the new current strip,

• if the obstacle does not extend over the whole width (d) of the current strip,

a stage (214b) to skirt the obstacle by continuing the journey over the current strip,

a stage to iterate the process from stage c3), as many times as necessary in order to scan the complex surface,

c7) a stage to continue the journey over the current strip (118_c, 120_c, 320_c, 322_c), running along the physical barrier or the obstacle and following the discontinuity until an angular rupture is encountered whose value is outside the limits of a predetermined range of permitted values,

• if the angular rupture thus encountered corresponds to a peripheral barrier, particularly a physical barrier or an obstacle with a concave shape, then a stage (216b) to enter into the said concave feature and to iterate the process from a) as many times as necessary in order to scan the complex surface,

• if the angular rupture thus encountered corresponds to a peripheral barrier, particularly a physical barrier or an obstacle that does not have a concave feature, then a stage (216a) to iterate the process from stage c1) as many times as necessary in order to scan the complex surface.

2. A process according to claim 1 ; where the said process also includes a stage for passing from the current strip (118_c, 120_c, 320_c, 322_c) to the next strip (118_s, 120_s, 320_s, 322_s) running along the physical barrier over a distance corresponding to the width of a strip and allowing for the local geometrical features of the physical barrier.

3. A process according to one of claims 1 or 2 ; where said geometrical data characterises the geometry of the physical barrier and/or obstacles, the geometry of the initialisation strip (118_i, 318_i), of the previous strip (118_p, 120_p, 322_p), of the current strip (118_c, 120_c, 320_c, 322_c), of the next strip (118_s, 120_s, 320_s, 322_s) can be deduced, at least in part, from a map of at least one part of the complex surface, the obstacles and the physical barriers.

4. A process according to claim 3, where the said map of the complex surface (100), the obstacles (414) and the physical barriers is created, in a dynamic manner, while scanning the said complex surface.

5. A system for scanning a complex surface (100) delimited at least in part by a physical barrier (102, 302) and/or obstacles (414), where the said system includes:

a mobile robot (104, 304, 404) which has detection resources (106) that are used to detect the said physical barrier and/or the said obstacles, and to supply, at least in part, the geometrical data (angles and lengths) characterising the geometry of the said physical barrier and/or the geometry of the said obstacles, as well as the geometry of the journey effected by the said mobile robot,

where the said robot (104, 304, 404) includes computer processing resources (110) which are used to control the movements of the said mobile robot as a function of the data supplied by the said detection resources,

where the said computer processing resources (110) include computing resources (112) used to execute an algorithm that includes the following stages:

a) a stage (200) to control the movement of the said mobile robot (104, 304, 404) up the said physical barrier, after detection of the latter by the said detection resources,

b) an initial stage

either

• to command the said mobile robot to traverse, in a first direction (114, 314), at least in part, an initialisation strip (118_i, 318_i) running along the said physical barrier (scanning the said strip), until the said physical barrier presents an angular rupture (120, 320) whose value is outside the limits of a predetermined range of permitted values, and then

• to command the said mobile robot to traverse, in the other direction (116, 316), in its entirety, the said initialisation strip (118_i, 318_i) running along at least one part the said physical barrier until the said physical barrier presents an angular rupture (122, 322) whose value falls outside the limits of a predetermined range of permitted values,

• or, wherever possible, to command the said mobile robot to traverse, in a single run, an initialisation strip running along at least one part the said physical barrier contained between two angular ruptures of the said physical barrier whose values fall outside the limits of a predetermined range of permitted values,

where the said computing resources are also used during the said initial stage to calculate the length (L_0) of the initialisation strip (118_i, 318_i) from the geometrical data (angles and lengths) supplied by the said detection resources and characterising the geometry of the initialisation strip ;

where the said computer processing resources (110) are used to execute an iterative process initialised by the journey over the said initialisation strip and continuing with

the journey over strips hereafter described as the previous strip (118_p, 120_p, 322_p), the current strip (118_c, 120_c, 320_c, 322_c) and the next strip (118_s, 120_s, 320_s, 322_s), where the first previous strip (118_p, 120_p, 322_p) is composed of the said initialisation strip (118_i, 318_i),

where the said initialisation strip (118_i, 318_i),, the said current strips (118_c, 120_c, 320_c, 322_c), the said previous strips (118_p, 120_p, 322_p) and the said next strips (118_s, 120_s, 320_s, 322_s) have a predetermined width (d),

and where the said computing resources (112) are used to determine the part of the complex surface remaining to be scanned by extracting the parts of the complex surface already scanned and then updating the geometrical characteristics of the said physical barrier delimiting the part of the complex surface remaining to be scanned,

c) where the said computer processing resources include computing resources which are also used to execute the following stages of the said algorithm:

c1) a stage (204) to predetermine the length (L^*_i) of the said current strip from the geometrical data characterising the geometry of the said previous strip,

c2) a stage (206) to command the mobile robot to traverse the said current strip in its entirety, running along the said previous strip until the said current strip presents an angular rupture whose value is outside the limits of a predetermined range of permitted values,

c3) a stage (208) to determine the length (L_i) of the said current strip from the geometrical data obtained during the journey over the said current strip and characterising the geometry of the said current strip,

c4) a stage (210) to compare the predetermined length (L^*_i) with the determined length (L_i), so that:

• if the predetermined length (L^*_i) is more or less equal to the determined length (L_i), then stage c5) of the algorithm is executed,

• if the predetermined length (L^*_i) is greater than the determined length (L_i), it is assumed that an obstacle is present on the current strip, and then stage c6) of the algorithm is executed.

• if the predetermined length (L^*_i) is less than the determined length (L_i), it is assumed that the physical barrier comprises a discontinuity in the said current strip and so stage c7) of the algorithm is executed,

c5) a stage (212) to command the mobile robot to pass to the next strip by laterally offsetting its trajectory over a distance that is more or less equal to the predetermined width (d) of one of the said current strips,

a stage to command the mobile robot to traverse the next strip in the direction opposite to that of the current strip,

a stage to command the mobile robot to iterate the algorithm from stage c1, with the former current strip now being considered to be the new previous strip, while the next strip is now considered to be the new current strip,

c6)

• if the obstacle extends over the width (d) of the current strip, then stage (214a) to command the mobile robot to pass to the next strip by laterally offsetting its trajectory over a distance that is more or less equal to the predetermined width (d) of one of the said current strips,

a stage to command the mobile robot to traverse the next strip in the direction opposite to that of the current strip,

a stage to command the mobile robot to iterate the algorithm from stage c1), with the former current strip now being considered to be the new previous strip, while the next strip is now considered to be the new current strip,

• if the obstacle does not extend over the whole width (d) of the current strip,

then a stage (214b) to command the mobile robot to skirt the obstacle by continuing the journey over the current strip,

a stage to command the mobile robot to iterate the algorithm from stage c3).

c7) a stage to command the mobile robot to continue the journey over the current strip, running along the physical barrier following the discontinuity until an angular rupture is encountered whose value is outside the limits of a predetermined range of permitted values,

• if the angular rupture thus encountered corresponds to a peripheral barrier that has a concave shape, then a stage (216b), to command the mobile robot to enter into the said concave feature and to iterate the algorithm from a)

• if the angular rupture thus encountered corresponds to a peripheral barrier that does not have a concave shape, then a stage (216a) to command the mobile robot to iterate the algorithm from stage c1).

6. A system according to claim 5 ; where the said processing resources (110) also command the mobile robot to pass from the current strip to the next strip, running along the physical barrier over a distance corresponding to the width of a strip, allowing for the local geometrical features of the physical barrier.

7. A system according to one of claims 5 or 6 ; where the said computer processing resources (110) are used to determine the said geometrical data characterising the geometry of the physical barrier and/or the obstacles, and the geometry of the initialisation strip, the previous strip the current strip, and the next strip, by deducing these, at least

in part, from a map of at least one part of the complex surface, of the obstacles and of the physical barriers.

8. A system according to claim 7 ; where the said computing resources are used to create, in a dynamic manner, the said map of the complex surface from data supplied by the said detection resources while scanning the said complex surface.

9. A system according to any one of claims 5 to 8 ; where the said detection resources include:

an infrared radiation emitter,

an infrared radiation receiver detecting the infrared radiation reflected by the concerned parts of the physical barrier or the obstacle ;

where the said computer processing resources are used to gradually vary the power of the infrared radiation emitted by the said emitter up to a power that is sufficient to detect the concerned parts of the physical barrier or obstacle, where the said computing resources are used to determine the relative position of the concerned parts of the said physical barrier or of the said obstacle in relation to the said mobile robot as a function of the said value of the detected power,

so that it is then possible, in a dynamic manner, as the robot is moving over the surface:

- to determine the geometrical data (angles and lengths) characterising the geometry of the obstacles or of the physical barrier, and/or
- to construct a map of the complex surface.

10. Application of the process according to claims 1 to 4, or of the system according to claims 5 to 9, to the implementation of a robot for the treatment of flat and/or

warped surfaces, of a robot for the treatment of wild or cultivated land, of a vacuum-cleaning robot, of a robotic lawn mower, of a robot employed to wash horizontal or inclined walls, particularly of the glazed or ceiling or roof type, or of a robot for the decontamination of complex contaminated surfaces.